MONETARY POLICY AND MALARIA OUTCOME IN NIGERIA: 1986 - 2018

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Abstract

The study investigates the effect of monetary policy on malaria outcome in Nigeria. Time series data covering 1991-2018 were sourced and subjected to preliminary test of descriptive statistic, Augmented Dickey-Fuller unit root test. The variables were normally distributed and integrated of order I(1). The Engle and Granger two stage Co-integration technique was used to determine the long run relationship between variables of interest and cointegration is confirmed. The Autoregressive Distributed Lag (ARDL) of Error Correction Model (ECM) techniques was adopted to determine the short run dynamics. Findings among other things show that monetary policy proxy by money supply has a significant negative effect on malaria outcome in the long run. Poverty rate has a significant positive effect on malaria outcome both in the short and long run period. Literacy rate and economic growth have a mixed effect on malaria outcome during the studied period. The study therefore recommends, inter alia, that poverty alleviation policy and malaria enlightenment campaign should be emphasized. The paper also recommends that government should use significant proportion of economic growth to sponsor malaria prevention and eradication vaccine.

Keywords: Malaria, Monetary-Policy, ARDL and Nigeria.

JEL Classification: I1, H5, H3, E2, E4, E7

1. INTRODUCTION

The objectives of monetary policy have remained to be the attainment of internal and external balance of payments (Yelwa & Doyoke, 2014). Over the years, however, techniques/instruments to achieve these objectives have changed. Monetary policy is a tool of general macroeconomic management, under the control of the monetary authorities, designed to achieve government economic objectives. Monetary policy aims at achieving certain national goals which have historically included full employment, high output, a stable price level, and a stable exchange

rate. Over the years thus, inflation targeting, and exchange rate policy have dominated CBN's monetary policy focus based on assumption that these are essential tools of achieving macroeconomic stability (Ajayi, 1999).

The Central Bank of Nigeria (CBN) will continue to ensure that the policy interest rate is delicately set to balance the objectives of price stability with output stabilization, targets GDP growth, and engages in quasi-fiscal activities, including the provision of subsidized development finance to selected sectors and using unconventional monetary policy tools to achieve its objectives (Emiefele, 2019). A large percentage of the Nigerian rural population has been plagued with several disease conditions with deleterious consequence on their health and livelihoods. One of such intractable diseases of the rural population is malaria. Malaria is a protozoan disease transmitted by the Anopheles mosquito, caused by minute parasitic protozoa of the genus Plasmodium, which infect human and insect hosts alternatively. Malaria often times afflicts poor people who live in malaria-prone rural areas in poorly-constructed buildings which have little or no protection against mosquito's attack (Urbanus, 2013). Monetary policy impacts the money supply in an economy, which influences interest rates and the inflation rate. It also impacts business expansion, net exports, employment, the cost of debt and the relative cost of consumption versus saving all of which directly or indirectly impact the general welfare and health condition of the citizens including the control of malaria (Urbanus, 2013).

The primary objective of malaria control is to reduce deaths and illness from the disease. The government of Nigeria and development partners has responded to the malaria scourge with various interventions. These include the Roll-Back-Malaria programme, the Millennium Development Goals (Goal No. 6), establishment of National Health Insurance Scheme, National Malaria Programme, among others. As part of government effort to combat malaria in the country, goal 6 and target 8 of Millennium Development Goals (MDGs) was aimed at halting the scourge and reversing the incidence of malaria and other major diseases with 2015 as timeline. The sustainable development goal has since replaced the MDGs as an intervention tool in this regard.

Malaria treatment or its prevention is affected by money supply, exchange rate, the efficiency of payments system, general economic stability, as measured by GDP per capita as well as poverty and literacy rates. The impact of monetary policy on malaria outcomes will depend on the response of the link variables to monetary policy impulses. Before now, considerable number of studies likes Balana and Robu (2014), Ogungbenle, Olawumi and Obasuyi (2013), Yelwa and Diyoke (2014), Idowu (2014), Aigbovo and Ezuem (2018) examined the relative impact of government and private expenditures on various health outcomes including tuberculosis on a country or her per capita income formation as well as on life expectancy, human capital development and economic growth. Apart from the study of Aigbovo and Ezuem (2018), none has examined the impact of monetary policy on malaria outcomes in Nigeria to the best of my knowledge. On this ground this study

examines the effect of monetary policy on malaria outcomes in Nigeria from 1990 to 2018 as the broad objective. Therefore, the study is relevant because it will help fill that gap in the literature by adding to the stock of the scanty empirical evidence on the impact of monetary policy on malaria outcomes in Nigeria. The specific objectives are to:

- examine the effect of broad money supply on malaria outcomes in Nigeria
- investigate the effect of poverty rate on malaria outcomes in Nigeria
- study the effect of literacy level on malaria outcomes in Nigeria
- determine the effect of economic growth on malaria outcomes in Nigeria

The rest of the paper is organised as follows; section II, present the review of related literature and theoretical framework. In section III, discuss the methodology. In section IV, present the empirical results and analysis, while section V concludes the study with recommendations.

2. REVIEW OF RELATED LITERATURE

With over 7.8 million cases of malaria, Nigeria has the highest caseload on the African continent. The disease remains one of the leading causes of avoidable death, especially in children and pregnant women. It is also responsible for about 30% of the under five-year-old deaths and a quarter of the infants that die each year. About 11% of women die from malaria during childbirth (WHO, 2017). The core interventions for controlling malaria in Nigeria include distribution of long-lasting insecticide-treated net through antenatal care clinics in the rural and urban areas, immunization visits, and large-scale stand-alone campaigns and through subsidized and at-cost sales in the commercial sector. Others include intermittent preventive treatment for pregnant women, prompt diagnosis at the various levels of health care, indoor residual spraying, increased community awareness as well as provision of free artemisinin-based combination therapy (ACT) for children below and above five years of age in some health centres, in both rural and urban areas**.** Funds have also been given by Nigeria government and other international bodies like: World Health Organization, Global Fund, United Nations Children Emergency Funds (UNICEF), etc.

Nigeria is home to the second largest number of people living in extreme poverty after India; 86 million in 2013, which represents 69 percent increase from 1990 (World Bank, 2017). It significantly underperforms on key health outcomes such as life expectancy, maternal mortality, and child health compared to regional and lower middle-income averages. Youth and adult literacy were 73 percent and 60 percent respectively in 2015 compared with global averages of 91 percent and 85 percent. And it consistently ranks in the lowest 20th percentile on worldwide governance indicators that measure the capacity of the government to effectively formulate and implement sound policies (World Bank, 2017). Malaria and poverty are intimately connected. It has long been recognized that a malarious community is

an impoverished community (Weller, 1958). Malaria is most intractable for countries in the poorest continent, Africa. The only parts of Africa free of malaria are the northern and southern extremes, which have the richest countries on the continent.

Economic growth itself might be a cause of the observed malaria reductions if greater resources were made available for malaria control, or if a high institutional capacity were responsible both for economic growth and successful malaria control.

Malaria prevalence, the number one cause of premature death in the country, also accounts for nearly half of out-of-pocket health expenditures (Institute for Health Metrics, 2017). As per capital resources necessary in relation to the scale of the problem remain scarce, governments are finding that they must use their available resources more efficiently in meeting their health objectives. These problems have amplified malaria effect on health outcome especially on under five mortality rate, low life expectancy and cost in Nigerian economy in terms of high government and private spending on health, reduction in labour supply, low productivity and income, high malaria cases and death. For example, malaria is estimated to account for 732,000 deaths among children aged 5 or less, or about 8% of all such deaths; the share in Africa is 16%, (World Bank, 2018). This implies that there has not been dramatic decrease in malaria cases and deaths in parallel with the intensified campaign and government as well as private spending against malaria

Concept of Monetary Policy and Its Channels

Monetary Policy refers to the specific actions taken by the Central Bank (Monetary Authority) to regulate the value; supply and cost of money in the economy with a view to achieving predetermine macroeconomic goal. Monetary policy influences the level of interest rate, exchange rate and cost of credit inconsonance with the level of economic activity (Ibeacbuchi, 2007). Macroeconomic aggregates such as output, employment and prices are, in turn, affected by the stance of monetary policy through a number of ways including interest rate; credit, wealth, and exchange rate channels (Akhatar, 1997).

Through the control of monetary policy targets such as the price of money (interest rate - both short term and long term), the quantity of money and reserve money amongst others; monetary authorities directly and indirectly control the demand for money, money supply, or the availability of money (overall liquidity), and hence affect output and private sector investment. When money supply increases, health improves, which lowers the chances of malaria cases and allows households to work longer hours and produce more output. Therefore, the price of health care services responds mildly to an expansionary monetary policy shock (Mehdi & Reza, 2011).

Furthermore, when the monetary policymaker shifts its policy and assigns a higher priority to output stabilization relative to exchange rate stabilization, it results in a smaller increase in the standard deviation of exchange rate in the health care sector compared with the regular goods sector (Wolman, A. L. 2011). And it is a

basic truth that poverty, mainly through malnourishment arising from lack of money to feed well and low per capita income, contributes to malaria cases. Poverty is a material deprivation, and this can be assessed in monetary terms (Anyanwu, 2002). The reduction of poverty is the most difficult challenge facing any country in the developing world where on the average majority of the population is considered poor. Evidences in Nigeria show that the number of those in poverty has continued to increase (Aliyu, 2002). There is need to increase public awareness of the growing risk presented by the resurgence of malaria. One of the major barriers identified in the efficacy of malaria treatment and prevention is the lack of health education and literacy. The lack of health education has decreased the efficacy of antimalarial drugs, such as Artemether Lumefantrine, due to the distribution and administration of the drug by untrained persons (Opiyo, Yamey & Garner, 2016). The lack of incidence and prevalence data makes it difficult to ensure adequate supply of the drug in endemic countries. Furthermore, the lack of knowledge of malaria pathogenesis and transmission has prevented many from promptly seeking treatment and practicing preventative care methods.

In countries where malaria is endemic, the lack of federal training guidelines for public health educators has significantly limited the treatment and control of the disease (Opiyo et al., 2016)

2.1. THEORETICAL LITERATURE

The Quantity Theory

The quantity theory was first developed by Irving fisher and came to the limelight in the inter-war years. It is a basic theoretical explanation for the link between money and the general price level (Geoff, 2012 in J.F Pixley, (ed) 2013). Irving Fisher, (1911), in his quantity theory of money opine, like other classical writers, that the short-run monetary control was dictated by interest rates which were sticky but in the long-run the demand for money influences, would determine the real cash balance. Fisher further assumed that the rise in commodity prices would precedes the increase in interest rate, since increased interest rate will motivate increased demand for money, which will cause reduction in price level through reduction in quantity of money in circulation. This was regarded as main channel of the firms operation cost (Jelilov, 2016). The Fisherian assertion can be expressed in an equation as:

$$MV = PT \qquad (2.1)$$

Where M is the actual money stock, V is the transaction velocity of circulation of money, P is the average price level and T is the number of transactions made per period. Fisher (1911), imposes the assumption that the equilibrium values of V and T will be fairly constant in the short run and invariant with respect to change in the quality of money. Given this assumption, equation (2.1) is thus being re-written as:

$$M = P\bar{T} \quad (2.2)$$

Where bars (-) signify that v and t are constant. Given that M is exogenously given, there must be proportional relationship in equilibrium between money supply (M) and the general price level. The quantity theory of money as employed by (Okafor, 2015), with a simple growth model, assumes that, the quantity theory of money is based on the link between the stock of money (M) and the market value of output that it finances (PY), where P is the price level and Y is the output. M is related to P with a factor of proportionality k, the relationship is given by:

$$M = kPY \quad (2.3)$$

$$\frac{M}{P} = KY \quad (2.4)$$

Factor of proportionality (K) is assumed to be constant. Thus, Equation (2.2) can actually be written as;

$$MV = PY \quad (2.5)$$

Where $V = \frac{1}{k}$ and this is the income velocity of money, the ratio of money income (nominal GDP) to the number of times the stock of money turns over in a given period in financing the flow of nominal income. Therefore, V is a useful concept in policy making. Equation (2.3) can be written in growth form:

$$M = PY\text{-}V \quad (2.6)$$

If V is constant, then V- 0 so that equation (2.6) yields

$$M = PY \quad (2.7)$$

This is the fulcrum of Central Bank of Nigeria (CBN) monetary targeting. The implication for this study, from the above discourse, is that, money supply in the economy will directly determine provision of goods and services through its variable instrument, such as, interest rate, exchange rate, to name but two, of which, physicians' services supply is part.

2.2. EMPIRICAL LITERATURE

An and Sun (2008) analyse the interaction among monetary policy, foreign exchange intervention and exchange rate in a unifying model for Japan. The research questions were:

- if monetary policy is the major source of the exchange rate fluctuation?
- if exchange rates "overshoot" their long-run values, in response to monetary policy shocks, as implied by the uncovered interest rate parity (UIP)?

The study was anchored on their study on the "signalling" and the "leaning-against-the-wind" theories to explore the relationship among monetary policy, foreign exchange intervention and movement of exchange rate in Japan. The findings from the study lend support to the "leaning-against-the-wind" hypothesis and "signalling" hypothesis, but the evidence for the "signalling" hypothesis was minor. The study concludes by pointing to the fact that in response to contractionary monetary policy shocks, the exchange rate appreciates for a short while with the maximum effect coming within several months, and then depreciates over time to the original level in Japan.

Olorunfemi and Dotun (2008) examined the impact of monetary policy on the economic performance in Nigeria using simple regression. The study found out that there was a negative relationship between interest rate and GDP on the one hand and inflation and GDP on the other. The study did not disaggregate the impact of monetary policy on the various sectors of the economy like the health sector.

Anyanwu and Erhijakpor (2007) examine health expenditure and health outcomes in Nigeria. The study provided econometric evidence linking African countries' per capita total as well as government health expenditures to two health outcomes: infant mortality and under-five mortality. Using 47 African countries; data that spans between 1999 and 2004. They found out that health expenditures have statistically significant effect on infant mortality and under-five mortality. For African countries, their results imply that total health expenditures (as well as the public component) are certainly important contributor to health outcomes. In addition, they also found out that both infant and under-five mortality positively and significantly affect the health outcomes, higher numbers of physicians and female literacy significantly reduce these health outcomes.

Abdulazeez (2016) uses time-series data covering the range of 1990 to 2010 examine the impact of monetary policy on economic growth in Nigeria. The study employed a multiple regression model, to analyse data on variables such as money supply, interest rate, financial deepening and gross domestic product. The results show that the variables have marginal impact on the economic growth rate of Nigerian economy due to change in monetary policy application.

3. METHODOLOGY

Research Design, Population and Sample, Source of data

The longitudinal research design is use in this study because the variables under consideration were gathered over a period of time and are historical in nature. The secondary data were collected from the Central Bank of Nigeria (CBN) Statistical Bulletin and World Bank data bank. Our sample chosen for this study is 1991 to 2018. This is based on the availability of relevant data.

Preliminary Test and Estimation Techniques

In carrying out the analysis of this study, the techniques of co-integration and Autoregressive Distributed Lag (ARDL) Error Correction Model (ECM) techniques are employed. However, the first stage is the descriptive statistic used to determine the properties of the variables and their normal distribution status presented in a convenient form. The Augmented Dickey Fuller (ADF) unit root test was conducted on the time series data, in order to determine the stationarity status of the variables. This is because the regression of a non-stationary series on another time series produces nonstationary series that implies a spurious regression results (Engle and Granger, 1987). The ADF model is given as;

$$\Delta Z_t = \beta_0 + \beta_1 Z_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta Z_{t-1} + \mu_t \quad - \qquad (3.1)$$

Where: μ_t~IIND (0, σ^2) and Z_t represents each series of the explanatory variables and dependent variable in the model. The t-statistics calculated are compared with the critical value obtain as constructed by Dickey and Fuller (1979) and Engle and Granger (1987) respectively. Having confirmed that the series are integrated of the same order, the Engle and Granger two stage co-integration test is carried out to determine the existence or otherwise of a long-run relationship exists between Malaria outcome and the explanatory variables (MS, GDP, PVR and LITR) in the model. The associated parsimonious error correction model is used to analyse the short run dynamic and long run equilibrium relationship among the variables. Finally, the post regression test for the presence or otherwise of serial correlation in ARDL models by Breusch Godfrey is carried out to validate the model's status in this regard.

Model Specification

This study seeks to examine the impact of monetary policy on malaria outcomes in Nigeria adapting quantity theory developed by Irving Fisher in the inter-war years.

The functional relationship of the model is:

$$MCASE = f(MS, GDPGR, PVR\ and\ LITR) \qquad (3.2)$$

Where MCASE is number of malaria outcome, MS is money supply, GDPGR is the growth rate of domestic product per capita, PVR is poverty rate and LITR is the Literacy Rate. U_t is the Error term.

The empirical form of the equation 3.2 if given as:

$$MCASE = \beta_0 + \beta_1 MS + \beta_2 GDPGR + \beta_3 PVR + \beta_4 LITR + U_t \qquad (3.3)$$

By log-linearizing the variables, the model is presented below as:

$$LMCASE = \beta_0 + \beta_1 LMS + \beta_2 LGDP + \beta_3 LPVR + \beta_4 LLITR + ECM_{t-1} + U_t \qquad (3.4a)$$

The ARDL lag model is given stated as:

$$\Delta LMCASE_t = \beta_0 + \sum_{i=0}^{n} \beta_{1i} \Delta LKCASE_{t-1} + \sum_{i=0}^{n} \beta_{2i} \Delta LMS_{t-1} + \sum_{i=0}^{n} \beta_{3i} \Delta LGDPGR_{t-1}$$

$$\sum_{i=0}^{n} \beta_{4i} \Delta LPVR_{t-1} + \sum_{i=0}^{n} \beta_{5i} \Delta LLITR_{t-1} + \sum_{i=0}^{n} \beta_{6i} ECM(-1)_{t-1} + \varepsilon t \quad (3.4b)$$

Where β_0 is the mean of the equation, $\beta_1 - \beta_6$ are the coefficients of the explanatory variables to be estimated, $ECM_{t-1}(-1)$ is error correction mechanism, ϵt is the stochastic error term and L is the Logarithmic log value of the variables. The a-*priori* expectation of the signs of the coefficients is given as $\beta_1, \beta_2, \beta_3, \beta_5, \beta_6, < 0$ $\beta_4 > 0$.

Operationalization of Variables

Malaria cases (MCASE) measured malaria prevalence which is the dependent variable

Money Supply (MS) proxy by annual broad money supply (M_2) Economic Growth rate (ΔGDP): change in total value of goods and services produced in a country over a period of time usually one year. $GDPGR = \frac{GDP_t - GDP_{t-1}}{GDP_t} * \frac{100}{1}$. Poverty Rate (PVR) and literacy rate (LITR) were proxy by annual value of these variables as computed by World Bank Development Index.

4. DATA PRESENTATION AND ANALYSES

Descriptive Statistic

Table 4.1 *Summary Statistic*

	MS	PVR	LITR	GRGDP	MLCASE
Mean	6.079310	60.17586	45.13103	4.567586	6.406400
Median	6.180000	58.60000	46.20000	4.800000	6.400000
Maximum	7.340000	80.10000	53.80000	10.60000	6.830000
Minimum	4.200000	46.40000	35.80000	-1.560000	5.950000
Std. Dev.	0.912093	6.826401	5.569759	3.132480	0.294730
Skewness	-0.390171	0.915342	-0.052871	-0.070566	-0.044028
Kurtosis	2.064009	4.182838	1.779472	2.370366	1.604041
Jarque-Bera	1.794390	5.740201	1.813550	0.503098	2.037973
Probability	0.407712	0.056693	0.403824	0.777595	0.360961

Source: Author's Computation Using E-view (2020)

The mean values in table 4.1 show that average money supply rate is 6.07, poverty rate is 60.17%, literacy rate is 45.13%, GDP grew at 4.5% while malaria cases stood at 640 per one thousand persons through the period of this study. This shows that dividend of economic growth are not translated to development. The indices of more than 60% poverty rate, literacy rate of less than 50% (45.13%), and malaria case of 640 per thousand persons in the face of a GDP growth rate of 4.5%

are not plausible testimonies of a developed economy. The money supply policy seems to be optimal because it is able to generate a GDP growth of 4.5% but that the other indices of development still remain low shows that the money supplied must have been inequitably distributed. The measures of dispersion data speak in the same direction. As shown from the table, the maximum, minimum and standard deviation values of money supply are 7.30, 4.20 and 0.91respectively. This shows that the monetary policy has been consistently tight as the range value is small as also verified by small standard deviation value of 0.91. Those of poverty rate show high level economic inequality with high range of 33.7% between its maximum (80.1%) and minimum (46.4%) values. This is also confirmed by a high standard deviation of 6.82. The figures shown in the table also confirm large scale literacy inequality. The figures are maximum 53.8 minimum 35.8 and standard deviation 5.56. GDP growth rate shows high level fluctuation and instability in economic growth trend. The respective maximum and minimum values over the period, are 10.6% and -1.56% respectively while the standard deviation is also high as 3.12. Malaria case was consistently high as shown from negligible difference between the maximum (6.83) and minimum (5.95) values confirmed by a small standard deviation (0.29). All these paint a picture of poor economic development.

The inferential statistics shows that, apart from PVR, all variables have a long tail to the left of their mean as shown by their corresponding negative Skewness value. Only PVR has a peak property distribution that is relative to normal as indicated by the Kurtosis value that is >3.0. Other variables possess flat distribution properties since their Kurtosis value is < 3.0. All the variables are normally distributed since their Jarque-Berra probability values are not significant at 5% level. This indicates that parameter estimates from the regression would be efficient.

4.1. UNIT ROOT TEST

Table 4.2 *Stationarity Test*

Variables	ADF Stat	Order	Remark
LMS	-3.372004***	I(1)	Stationary
LPVR	-5.149161*	I(1)	Stationary
LLITR	-7.340201*	I(1)	Stationary
GRGDP	-5.750288*	I(1)	Stationary
LMLCASE	9.753312*	I(1)	Stationary
Critical Values			
1%	-4.467895	First Diff	
5%	-3.644963	First Diff	
10%	-3.261452	First Diff	
***, ** and *** Means 1%, 5% and 10% level of Significance**			

Source: Author's Computation Using E-view (2020)

From table 4.2, it can be seen that all the variables are stationary at first difference. Thus, the null hypothesis of there is no unit root is accepted. This means that all the variables are confirmed integrated of order *I*(1) as indicated by the Augmented Dickey-Fuller test. Hence, the study proceeds to estimate the long run relationship (co-integration) between the health dependent variable and the its explanatory variables under consideration.

4.2. TWO STAGE CO-INTEGRATION TEST

Table 4.3 *Engle-Granger Co-integration Test.*

Variables	ADF Stat	Critical Value	Order	Remark
ECM (RESID)	-5.307952*	-4.416345	I(0)	Stationary
* indicates 1% level of Significance				

Source: Author's Computation Using E-view (2020)

The ADF statistic value for the residuals at levels is greater than the critical value at 1% level. Hence, the null hypothesis of there is no co-integrating relationship between LMLCASE and its explanatory variables is rejected at 95% confidence level. This means that any variable that deviate in the short run will converge to equilibrium in the long run. All co-integrating variables embodied an error correction element. Thus, the parsimonious Error Correction Model (ECM) is estimated.

4.3. PARSIMONIOUS ECM ESTIMATES

Table 4.4 *ECM Short Run Result*

ECM Short Run Result			
ΔLMLCASE Dependent Variable			
Variable	**Coefficient**	**t-Statistic**	**Prob.**
C	-1.994316	-1.188717	0.2596
LMLCASE(-1)	1.433131*	3.914562	0.0024
LMS	9.84E-09	0.577209	0.5754
LMS(-1)	-1.75E-08	-1.083724	0.3017
LPVR	-0.006478***	-2.063975	0.0634
LPVR(-1)	0.010916*	3.339907	0.0066
LLITR	-0.005899	-0.411788	0.6884
LLITR(-1)	-0.030359**	-2.254194	0.0456
LLITR(-2)	0.013364	1.132256	0.2816
LGRGDP	-0.001311	-0.170672	0.8676
LGRGDP(-1)	0.007918	0.998973	0.3393
ECM(-1)	-0.110030**	-2.760995	0.0185
R-squared	0.973443		
Adjusted R-squared	0.946887		

F-statistic	36.65531		
Prob(F-statistic)	0.000000		
Durbin-Watson stat	1.919031		

** indicates 5% level of Significance

Source: Author's Computation Using E-view (2020)

Table 4.5. *Breusch-Godfrey Serial Correlation LM Test*

F-statistic	0.597807	Prob. F(2,9)	0.5705
Obs*R-squared	2.697152	Prob. Chi-Square(2)	0.2596

Source: Author's Computation Using E-view (2020)

Table 4.4 is the ECM short run result. From it, it is seen that one period lag values of malaria case, money supply, poverty rate, literacy rate and current period value of GDP are correctly signed. This implies that all the variables, apart from GDP, impact on malaria out come with a lag. In all, one period lag values of malaria case, poverty rate and literacy rate are statistically significant at 5% level of significance. Money supply and GDP are not. This still corroborates the earlier observation from the descriptive statistics that even though GDP grows, its growth has not translated into improvement of the social and health indices of the Nigerian economy. Hence, minimization of diseases and malaria out come in particular, as a crucial index of economic development is not realized. The results further, show that 1% increase in previous period malaria case would increase current period malaria case with 14.3%, 1% increase in last period of literacy rate will reduce malaria case with 3% and that 1% increase in one past period of poverty rate would reduce malaria case with 1%. The error correction mechanism variable (ECM) is correctly signed and statistically significant at 5%. By its value, it implies that 11% of the dynamic variation between shot and long runs dynamics are reconciled annually. The Durbin-Watson statistic of 1.91 for both the short and long run results is sufficiently close to 2, implying that the likely presence of serial correlation is minimized. This is however augmented by the Breusch-Godfrey Serial Correlation LM test because the specified ECM model is an autoregressive distributed lag (ARDL) model. The test result rejects the alternate hypothesis (H_i) of there is serial correlation up to order two (2). Thus, the null hypothesis (Ho) of there is no serial correlation is accepted since the probability value 0.57 > 0.05. This indicates the absence of serial correlation in the model. Thus, the model is valid and can be used for policy recommendation without further re-specification. See table 4.5.

The global test statistic of significance for dependent and the explanatory variables combined (F-stat.) reads 36.6 and it is statistically significant at 1%. This shows that there statistically significant simultaneous relationship among the variables of the model. The coefficient of determination R^2 is 97.3% when adjusted to its degree of freedom it becomes 94.6%. This shows that the explanatory variables in the model account for up to 94.6% systematic variations in malaria out come in Nigeria.

4.4. LONG RUN REGRESSION ESTIMATE

Table 4.6. *OLS Long Run Result*

OLS Long Run Regression Result			
Variable	**Coefficient**	**t-Statistic**	**Prob.**
Dependent Variable: LMLCASE			
Independent Variables			
C	6.092172	6.742907	0.0000
LMS	-2.74E-08**	-2.776148	0.0149
LPVR	0.009245**	2.233678	0.0423
LITR	0.018368	0.967102	0.3499
LGRGDP	0.000481	0.039242	0.9693
R-squared	0.873822		
Adjusted R-squared	0.828759		
F-statistic	19.39088		
Prob(F-statistic)	0.000008		
D.W Stat	1.919423		

** indicates 5% level of Significance

Source: Author's Computation Using E-view (2020)

Table 4.6 is the long run regression result. From it, it is observed that money supply and poverty rate are still correctly signed. Literacy rate, though, no longer correctly signed is not statistically significant. GDP, on its part, is still statistically not significant and also no longer correctly signed. Money supply and poverty rate are statistically significant at 5% level. The implication of this is that in the long run monetary policy is important in influencing malaria outcome in Nigeria. Poverty rate remains a consistent variable in modelling malaria outcome in Nigeria. This is confirmed by its consistency in correct sign and statistical significance. Literacy rate becomes not very significant in modelling malaria in Nigeria. This could probably be attributed to high rate of unemployment and dysfunctional education curriculum. Thus, in the long run literacy rate does not have serious consideration in annals of malaria outcome in Nigeria because it takes an employed individual to have money to pay for treatment and the educated person has to know enough, to understand the benefits of hygiene and neat environment. GDP is consistently not correctly signed and not statistically significant in the long run. This still confirms the fact that even though there is economic growth, its effect is not translated into improvement of health and education of the populace.

5.0. POLICY IMPLICATION

The above results have interesting implication for policy consideration. They are as shown below:

- Monetary policy is very significant in modelling malaria case in Nigeria, at least, in the long run.

- GDP growth does not translate into malaria reduction and thus does not improve on health indices of Nigeria.
- The high standard deviations, as a measure of dispersion, in GDP and literacy rate show high level income and education inequality.
- Poverty rate is very critical in determining malaria out come in Nigeria.
- Literacy rate as a crucial health enabling factor can only work when enhanced with employment and functional curriculum in schools.

5.1. SUMMARY AND CONCLUSION

Monetary policy is a systematic control of monetary instrument, with a view to achieving major macroeconomic aggregates in any economy. Such economic aggregates include; sustainable economic growth and economic development. One of the crucial indices of development is improved health for increased productivity. Malaria is one major negative health outcome that plagues tropical African countries, of which Nigeria is one. It has debilitating effects on the victims that reduces ability to work and also reduces the number of working hours supplied by the affected individual. Thus, in the process of macroeconomic management of the economy of Nigeria, attainment of optimum health by minimizing the malaria plague is critical. The outcome of this study has shown that poverty rate and monetary policy has statistically significant long run impact on malaria reduction and that there is reasonable economic growth over the period of study. Literacy rates and economic growth are not statistically significant even though they show correct a-priori conformity. This shows that the benefits of economic growth are not translated into the needed socioeconomic enhancement of the populace in Nigeria. It also implies that there is high level income and education inequality in the economy as verified in the high values of the measures of dispersion, in the descriptive statistics.

The goodness-of-fit of the model is very good as shown by the relevant test statistics of F-Statistic and$\bar{R}^2$. The DW statistic also shows that the parameter estimates are efficient, which means that the explanatory variables in the model are optimal in predicting malaria outcome in Nigeria within the period of study.

5.2. POLICY RECOMMENDATION

Base on the fore going, the following are recommended:

- There should be significant proportion of money supply to the health sector and malaria aids from international organization like World Health Organisation should be strictly monitored and judiciously used for combating malaria in Nigeria.
- The government should use significant proportion of economic growth to sponsor malaria prevention and purchase of eradication vaccine.
- Relevant fiscal efforts should be put in place to enhance aggregate demand so as alleviate poverty.

- Standard of living should be increased via poverty alleviation for poverty rate to continue to have significant reduction effect on malaria outcome.
- Government should invest more in rural education and malaria awareness education to enlighten people on how best to prevent and manage malaria outcome.
- Literacy rate should be enhanced by increasing access to training to reduce education inequality.
- Curriculum re-engineering for quality education should be emphasized by education experts, so as to enhance employability of labour output from schools.
- Monetary policy efforts should be made at curbing economic inequalities.

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APPENDICES

	MS01	PVR	LITR	GRGDP	MLCASE
Mean	6.079310	60.17586	45.13103	4.567586	6.406400
Median	6.180000	58.60000	46.20000	4.800000	6.400000
Maximum	7.340000	80.10000	53.80000	10.60000	6.830000
Minimum	4.200000	46.40000	35.80000	-1.560000	5.950000
Std. Dev.	0.912093	6.826401	5.569759	3.132480	0.294730
Skewness	-0.390171	0.915342	-0.052871	-0.070566	-0.044028
Kurtosis	2.064009	4.182838	1.779472	2.370366	1.604041
Jarque-Bera	1.794390	5.740201	1.813550	0.503098	2.037973
Probability	0.407712	0.056693	0.403824	0.777595	0.360961
Sum	176.3000	1745.100	1308.800	132.4600	160.1600
Sum Sq. Dev.	23.29359	1304.793	868.6221	274.7481	2.084776
Observations	29	29	29	29	25

Null Hypothesis: D(MS) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 6 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.372004	0.0823
Test critical values:	1% level	-4.467895	
	5% level	-3.644963	
	10% level	-3.261452	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MS,2)
Method: Least Squares
Date: 02/22/20 Time: 00:42
Sample (adjusted): 1998 2018
Included observations: 21 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MS(-1))	-6.993615	2.074023	-3.372004	0.0055
D(MS(-1),2)	5.040463	1.899455	2.653636	0.0210
D(MS(-2),2)	5.704858	1.814051	3.144817	0.0085
D(MS(-3),2)	6.188054	2.083593	2.969895	0.0117
D(MS(-4),2)	2.719095	1.956048	1.390096	0.1897

D(MS(-5),2)	5.032977	1.751896	2.872875	0.0140
D(MS(-6),2)	3.482821	2.119138	1.643508	0.1262
C	-4665583.	2708241.	-1.722735	0.1106
@TREND(1990)	494634.3	205322.5	2.409060	0.0330

R-squared	0.975872	Mean dependent var	-1032975.
Adjusted R-squared	0.959786	S.D. dependent var	12381870
S.E. of regression	2482981.	Akaike info criterion	32.58534
Sum squared resid	7.40E+13	Schwarz criterion	33.03300
Log likelihood	-333.1461	Hannan-Quinn criter.	32.68250
F-statistic	60.66785	Durbin-Watson stat	2.686623
Prob(F-statistic)	0.000000		

Null Hypothesis: D(PVR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.149161	0.0015
Test critical values:	1% level	-4.339330	
	5% level	-3.587527	
	10% level	-3.229230	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(PVR,2)
Method: Least Squares
Date: 02/22/20 Time: 00:45
Sample (adjusted): 1992 2018
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PVR(-1))	-1.109655	0.215502	-5.149161	0.0000
C	2.250044	2.643004	0.851321	0.4030
@TREND(1990)	-0.169952	0.156385	-1.086753	0.2879

R-squared	0.531850	Mean dependent var	-0.344444
Adjusted R-squared	0.492838	S.D. dependent var	8.879334
S.E. of regression	6.323447	Akaike info criterion	6.630845
Sum squared resid	959.6634	Schwarz criterion	6.774827
Log likelihood	-86.51641	Hannan-Quinn criter.	6.673658
F-statistic	13.63282	Durbin-Watson stat	1.925261
Prob(F-statistic)	0.000111		

Null Hypothesis: D(LITR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.340201	0.0000
Test critical values:	1% level	-4.339330	
	5% level	-3.587527	
	10% level	-3.229230	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LITR,2)
Method: Least Squares
Date: 02/22/20 Time: 00:45
Sample (adjusted): 1992 2018
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LITR(-1))	-1.381396	0.188196	-7.340201	0.0000
C	0.900265	0.570201	1.578855	0.1275
@TREND(1990)	-0.003115	0.032673	-0.095337	0.9248

R-squared	0.692228	Mean dependent var	-0.011111
Adjusted R-squared	0.666580	S.D. dependent var	2.286471
S.E. of regression	1.320266	Akaike info criterion	3.497982
Sum squared resid	41.83444	Schwarz criterion	3.641964
Log likelihood	-44.22276	Hannan-Quinn criter.	3.540796
F-statistic	26.98989	Durbin-Watson stat	2.120484
Prob(F-statistic)	0.000001		

Null Hypothesis: D(GRGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.750288	0.0004
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GRGDP,2)
Method: Least Squares
Date: 02/22/20 Time: 00:46
Sample (adjusted): 1993 2018
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GRGDP(-1))	-1.555206	0.270457	-5.750288	0.0000
D(GRGDP(-1),2)	0.427427	0.187196	2.283310	0.0324
C	0.812235	1.128243	0.719912	0.4792
@TREND(1990)	-0.070784	0.065955	-1.073221	0.2948

R-squared	0.645688	Mean dependent var	0.087692
Adjusted R-squared	0.597373	S.D. dependent var	3.923498
S.E. of regression	2.489572	Akaike info criterion	4.802737
Sum squared resid	136.3553	Schwarz criterion	4.996290
Log likelihood	-58.43558	Hannan-Quinn criter.	4.858473
F-statistic	13.36408	Durbin-Watson stat	1.794999
Prob(F-statistic)	0.000035		

Null Hypothesis: D(MLCASE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.753312	0.0000
Test critical values:	1% level	-4.416345	
	5% level	-3.622033	
	10% level	-3.248592	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MLCASE,2)
Method: Least Squares
Date: 02/22/20 Time: 00:47
Sample (adjusted): 1992 2014
Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MLCASE(-1))	-1.605848	0.164646	-9.753312	0.0000
C	0.068815	0.034723	1.981810	0.0614
@TREND(1990)	-0.001059	0.002363	-0.447982	0.6590

R-squared	0.827140	Mean dependent var	0.004783
Adjusted R-squared	0.809854	S.D. dependent var	0.172307
S.E. of regression	0.075136	Akaike info criterion	-2.217932
Sum squared resid	0.112908	Schwarz criterion	-2.069824
Log likelihood	28.50622	Hannan-Quinn criter.	-2.180684
F-statistic	47.85026	Durbin-Watson stat	1.793077
Prob(F-statistic)	0.000000		

Dependent Variable: MLCASE
Method: Least Squares
Date: 02/22/20 Time: 00:56
Sample (adjusted): 1995 2014
Included observations: 20 after adjustments
Convergence achieved after 1 iteration

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.092172	0.903493	6.742907	0.0000
LMS	-2.74E-08	-9.87E-09	-2.776148	0.0149
LPVR	0.009245	0.004139	2.233678	0.0423
LITR	0.018368	0.018993	0.967102	0.3499
LGRGDP	0.000481	0.012253	0.039242	0.9693
AR(5)	0.002497	0.451960	0.005525	0.9957

R-squared	0.873822	Mean dependent var	6.501000
Adjusted R-squared	0.828759	S.D. dependent var	0.248890
S.E. of regression	0.102994	Akaike info criterion	-1.464965
Sum squared resid	0.148509	Schwarz criterion	-1.166246
Log likelihood	20.64965	Hannan-Quinn criter.	-1.406652
F-statistic	19.39088	Durbin-Watson stat	1.919423
Prob(F-statistic)	0.000008		

Inverted AR Roots	.30	.09+.29i	.09-.29i	-.24-.18i
	-.24+.18i			

Null Hypothesis: ECM has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.307952	0.0015
Test critical values:	1% level	-4.416345	
	5% level	-3.622033	
	10% level	-3.248592	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ECM)
Method: Least Squares
Date: 02/22/20 Time: 01:06
Sample (adjusted): 1992 2014
Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM(-1)	-1.139742	0.214724	-5.307952	0.0000
C	0.003957	0.038611	0.102489	0.9194
@TREND(1990)	9.81E-05	0.002654	0.036977	0.9709

R-squared	0.589104	Mean dependent var	0.003140
Adjusted R-squared	0.548014	S.D. dependent var	0.124371
S.E. of regression	0.083615	Akaike info criterion	-2.004091
Sum squared resid	0.139828	Schwarz criterion	-1.855983
Log likelihood	26.04705	Hannan-Quinn criter.	-1.966843
F-statistic	14.33705	Durbin-Watson stat	1.857557
Prob(F-statistic)	0.000137		

Dependent Variable: MLCASE
Method: Least Squares
Sample (adjusted): 1992 2014
Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.994316	1.677705	-1.188717	0.2596
LMLCASE(-1)	1.433131	0.366103	3.914562	0.0024
LMS	9.84E-09	1.71E-08	0.577209	0.5754
LMS(-1)	-1.75E-08	1.62E-08	-1.083724	0.3017
LPVR	-0.006478	0.003139	-2.063975	0.0634
LPVR(-1)	0.010916	0.003268	3.339907	0.0066
LLITR	-0.005899	0.014326	-0.411788	0.6884
LLITR(-1)	-0.030359	0.013468	-2.254194	0.0456
LLITR(-2)	0.013364	0.011803	1.132256	0.2816
LGRGDP	-0.001311	0.007683	-0.170672	0.8676
LGRGDP(-1)	0.007918	0.007926	0.998973	0.3393
ECM(-1)	-0.110030	0.402040	-2.760995	0.0185

R-squared	0.973443	Mean dependent var	6.441739
Adjusted R-squared	0.946887	S.D. dependent var	0.279669
S.E. of regression	0.064454	Akaike info criterion	-2.339864
Sum squared resid	0.045697	Schwarz criterion	-1.747432
Log likelihood	38.90844	Hannan-Quinn criter.	-2.190869
F-statistic	36.65531	Durbin-Watson stat	1.919031
Prob(F-statistic)	0.000000		